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अल्प-वोल्टता स्विच गियर और नियंत्रण गियर समुच्चयों की विशिष्टि

भाग 3 अकुशल कार्मिकों द्वारा उपयोग की स्थिति के लिये उपस्कर की विशेष अपेक्षाएँ

Indian Standard

SPECIFICATION FOR LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR ASSEMBLIES

PART 3 PARTICULAR REQUIREMENTS FOR EQUIPMENT WHERE UNSKILLED PERSONS HAVE ACCESS FOR THEIR USE

(IEC Title : Low-Voltage Switchgear and Controlgear Assemblies — Part 3 : Particular Requirements for Low-Voltage Switchgear and Controlgear Assemblies Intended to be Installed in Places Where Unskilled Persons Have Access for Their Use — Distribution Boards)

(Second Reprint MARCH 1999)

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NEW DELHI 110002

June 1993 **Price Group 6**

Low Voltage Switchgear and Controlgear Sectional Committee, ET 07

NATIONAL FOREWORD

This Indian Standard (Part 3) is identical with IEC Pub 439-3 (1990) Part 3 : Covering requirements for assemblies for use by unskilled persons. Distribution boards shall comply with all requirements given in Part 1 of this standard; if not otherwise indicated hereinafter and shall *also comply with the particular requirements contained in this part.*

The text of the IEC standard has been considered and approved by ET 07, Low Voltage Switchgear and Controlgear Sectional Committee of BIS, as suitable for publication as Indian Standard The requirements covered in this standard is applicable to product types covered in IS 2675, IS 5039 and IS 13032 These standards are therefore being reviewed.

This standard is required to be read in conjunction with Part 1 which covers general requirements of all switchgear and controlgear assemblies for voltages not exceeding 1 000 V ac or 1 200 dc.

CROSS REFERENCES

In this Indian Standard the following International Standards are referred to. Read in their respective place the following:

International Standard (IEC)	*Indian Standard*
269-3 (1987)	Nil
529 (1989)	IS 12063
695-2-1 (1980)	Nil

All these Indian Standards are technically equivalent to the corresponding International Standards

As regards IEC 269-3, reference is invited to the type of fuses used in household applications covered in IS 2086 Carriers and bases used in rewirable type electrical fuses up to 650 volts (*second revision*)'

In the case of IEC 695-2-1, the Technical Committee responsible for this standard has approved its use in conjunction with this standard.

AMENDMENT NO. 1 JUNE 1997
TO
IS 8623 (PART 3) : 1993/IEC PUB 439-3 (1990)
SPECIFICATION FOR LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR ASSEMBLIES

PART 3 PARTICULAR REQUIREMENTS FOR EQUIPMENT WHERE UNSKILLED PERSONS HAVE ACCESS FOR THEIR USE

INTRODUCTION

The clauses of the document supplement, modify or replace the corresponding clauses in IEC 439-3 – First edition (1990): Low voltage switchgear and controlgear assemblies – Part 3: Particular requirements for low-voltage switchgear and controlgear assemblies intended to be installed in places where unskilled persons have access for their use – Distribution boards.

Where there is no corresponding clause or subclause in this amendment, the clause or subclause of IEC 439-3: 1990 applies without modifications.

Page 1

1.1 Scope

Delete the last sentence Requirements for assemblies for outdoor use are under consideration.

Page 4

5.1 *Nameplates*

Add.

Replace "Information specified under items a) and b). " by "Information specified under items a), b), c), d), e), l) and r)..."

Replace "Information specified under items c) to q).. " by "Information specified from the remaining items."

Page 6

7 4 2.2 1 *Replace "external" by "accessible".*

Insert the following subclause·

7 4 2 2 3a) *Add the following text:*

If a key or tool is provided to prevent unauthorized access to fuses, lamps and similar devices (which need occasional handling) item d) shall apply.

Page 7

8.1 *Replace Table 7 by the following*

Table 7 – List of type tests to be performed

	Characteristics to be checked	Subclause	Type test according to 8.1.1	Test order in sequence		
				A	B	C
a)	Temperature-rise limits	8.2.1	Verification of temperature-rise limits by test	3*		
b)	Dielectric properties	8.2.2	Verification of dielectric properties by test	4		2
c)	Short-circuit withstand strength	8.2.3	Verification of the short-circuit withstand strength			1*
d)	Effectiveness of the protective circuit	8.2.4				3*
	Effective connection between the exposed conductive parts of the assembly and the protective circuit	8.2.4.1	Verification of the effective connection between the exposed conductive parts of the assembly and the protective circuit by inspection or by resistance measurement			
	Short-circuit withstand strength of the protective circuit	8.2.4.2	Verification of the short-circuit withstand strength of the protective circuit by test			
e)	Clearances and creepage distances	8.2.5	Verification of clearances and creepage distances		2*	
f)	Mechanical operation	8.2.6	Verification of mechanical operation		1	
g)	Degree of protection	8.2.7	Verification of degree of protection	6*		
h)	Construction and marking	8.2.8	Verification of construction and marking	1*		
i)	Impact strength	8.2.9	Verification of impact strength	5		
j)	Resistance to rusting and to humidity	8.2.10 8.2.13	Verification of resistance to rusting and to humidity			4
k)	Resistance of insulating materials to heat	8.2.11	Verification of resistance of insulating materials to heat		4	
l)	Resistance of insulating materials to abnormal heat and to fire	8.2.12	Verification of resistance of insulating materials to abnormal heat and to fire due to internal electric effects		3	
m)	Mechanical strength of fastening means of enclosures	8.2.14	Verification of mechanical strength of fastening means of enclosures	2		

* No failures by any samples

Add Table 7b:

Table 7b – List of routine tests to be performed

	Characteristics to be checked	Subclauses	Routine test according to 8.1.2	
a)	Wiring, electrical operation	8.3.1	Inspection of the assembly including inspection of wiring and, if necessary, electrical operation test	
b)	Insulation	8.3.2	Dielectric test	
c)	Protective measures	8.3.3	Checking of protective measures and of the electrical continuity of the protective circuits	

Page 8

8.1.1 *Type tests* (see 8.2)

Replace this subclause by the following:

Type tests are intended to verify compliance with the requirements laid down in this standard for a given type of ASSEMBLY.

Type tests shall be carried out on a sample of such an ASSEMBLY or on parts of ASSEMBLIES manufactured to the same or similar design. They shall be carried out on the initiative of the manufacturers.

Type tests include:

a)	Verification of temperature-rise limits	8.2.1
b)	Verification of the dielectric properties	8.2.2
c)	Verification of the short-circuit strength	8.2.3
d)	Verification of the continuity of the protective circuit	8.2.4
e)	Verification of clearances and creepage distances	8.2.5
f)	Verification of mechanical operation	8.2.6
g)	Verification of the degree of protection	8.2.7
h)	Verification of construction and marking	8.2.8
i)	Verification of impact strength	8.2.9
j)	Verification of resistance to rusting and to humidity	8.2.10 8.2.13
k)	Verification of resistance of insulating materials to heat	8.2.11
l)	Verification resistance to abnormal heat and to fire	8.2.12
m)	Verification of mechanical strength of fastening means of enclosures	8.2.14

The type tests are arranged in three separate sequences as detailed in table 7a. A sample selected for testing to a given sequence shall complete all the test in that sequence in the order stated.

Table 7a – Sequence of type tests

Sequence reference	Type tests
A	h), m), a), b), i), g)
B	f), e), l), k)
C	c), b), d), j)

Four separate samples shall be provided for each test sequence. There shall be no failures by any samples during any of the tests a), c), d), e), g) or h). If the first sample submitted to a test sequence completes the sequence satisfactorily no further testing to that sequence is required. If, however, a sample submitted to a test according to b), f), i), j), k), l) or m) fails, the relevant test sequence has to be repeated on the remaining three samples and there shall be no failure.

Page 9

8.2.9 *Verification of impact strength*

Replace "Under consideration" by the following:

8.2.9 *Verification of impact strength*

Compliance is checked on those exposed parts of the DBU which may be subjected to mechanical impact when mounted as in normal use.

8.2.9.1 The test shall be carried out by means of a spring hammer test apparatus as described in IEC 68-2-63: 1991, Test Eg: Impact, spring hammer. The test is made after the sample has been for 2 h at a temperature of –5 °C ± 1 K and each blow shall have an impact of 0,7 J.

8.2.9.2 The sample with cover, or the enclosure, if any, shall be fixed as in normal use or placed against a rigid support.

Three blows shall be applied on separate places of each of the five accessible faces and door (if provided). They shall not be applied to knock-outs, built-in components complying with other standards, or other fastening means which are recessed below the surface so as not to be subject to impact.

Cable entries which are not provided with knock-outs shall be left open. If they are provided with knock-outs, two of them shall be opened.

Before applying the blows, fixing screws of bases, covers and the like shall be tightened with a torque equal to that specified in table 13

Table 13 – Tightening torques for the verification of mechanical strength

Diameter of thread mm		Tightening torque Nm		
Metric standard values mm	Range of diameters "d" mm	I	II	III
2,5	d ≤ 2,8	0,13	0,26	0,26
3,0	2,8 < d ≤ 3,0	0,16	0,33	0,33
–	3 < d ≤ 3,2	0,20	0,40	0,40
3,5	3,2 < d ≤ 3,6	0,26	0,53	0,53
4	3,6 < d ≤ 4,1	0,47	0,80	0,80
4,5	4 1 < d ≤ 4,7	0 53	1,20	1,20
5	4,7 < d ≤ 5,3	0,53	1,33	1,33
6	5,3 < d ≤ 6	0,80	1,66	2,00
8	6 < d ≤ 8	1,66	2,33	4,00
10	8 < d ≤ 10	–	2,66	6,66
12	10 < d ≤ 12	–	–	9,33
14	12 < d ≤ 15	–	–	12,6
16	15 < d ≤ 20	–	–	16,6
20	20 < d ≤ 24	–	–	24
24	24 < d	–	–	33

Column I applies to screws without heads which, when tightened, do not protrude from the hole, and to other screws which cannot be tightened by means of a screwdriver with a blade wider than the root diameter of the screw.

Column II applies to nuts and screws which are tightened by means of a screwdriver.

Column III applies to nuts and screws which can be tightened by means other than a screwdriver

8 2 9 3 After the test the samples shall show no damage within the meaning of this standard In particular, the following items shall not show such damage.

- covers which, when broken, make live parts accessible or impair the further use of the equipment,
- operating means;
- linings and barriers of insulation material and the like.

In case of doubt, it shall be verified that removal and replacement of external parts, such as enclosures and covers, is possible without these parts or their lining being damaged.

Cracks not visible with normal or corrected vision without additional magnification and surface cracks in fibre reinforced mouldings and the like shall be ignored. Small dents which do not reduce the creepage distances or clearances below the values specified and small chips which do not adversely affect the protection against electric shock shall be neglected

Page 12

8.2.12.5 *Severities*

Add the following sentence after table 12:

For the purpose of this test a protective conductor (PE) is not considered to be a current-carrying part.

Add new subclauses as follows:

8.2 13 *Verification of resistance to humidity*

The resistance to humidity of the DBU shall be verified according to IEC 68-2-3: 1969, Basic environmental testing procedures – Part 2: Tests – Test Ca: Damp heat, steady state, under the following test conditions:

The test shall be applied to the DBU with the enclosure together with the busbars and terminals, but without other components which are covered by their own product standards in place.

Inlet openings, if any, shall be left open. If knock-outs are provided, one of them shall be opened.

Parts which can be removed without the aid of a tool shall be removed and subjected to the humidity treatment with the main parts. Spring lids shall be open during this treatment.

Before being placed in the testing chamber, the samples shall be stored at room temperature for at least 4 h before the test.

Test duration shall be 4 days.

After this period the removed parts are reinstalled and the lid closed

The equipment is then submitted to a power frequency test voltage, for 1 min, the value shall be 2 U_e with a minimum of 1 000 V between the different parts as specified in the future annex K of IEC 947-1: 1988, Low-voltage switchgear and controlgear – Part 1. General rules. This verification shall be made within one hour of the end of the 4-day period

8 2 14 *Verification of mechanical strength of fastening means of enclosures*

This test is applied only to items which are not an integral part of other components covered by their own product standards.

The screws or nuts shall be tightened and loosened:

- 10 times when in engagement with a thread of insulating material;
- 5 times in all other cases.

Screws or nuts in engagement with a thread of insulating material shall be completely removed and reinserted each time.

The test shall be made by means of a suitable screwdriver or spanner applying a torque as given in table 13

The screws or nuts shall be tightened without jerks

Where a screw has a hexagonal head with a slot for tightening with a screwdriver and the values in columns II and III of table 13. are different, the test shall be made twice:

- first applying to the hexagonal head the torque specified in column III by means of the spanner,
- then, on a new sample, applying the torque specified in column II by means of the screwdriver.

If the values in columns II and III are the same, only the test with the screwdriver shall be made.

During the test, the screwed connections shall not work loose and there shall be no damage, such as breakage of screws or damage to the head slots, threads, washers or stirrups, or damage to enclosures and covers, that will impair the further use of the equipment.

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SPECIFICATION FOR LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR ASSEMBLIES

PART 3 PARTICULAR REQUIREMENTS FOR EQUIPMENT WHERE UNSKILLED PERSONS HAVE ACCESS FOR THEIR USE

1 General

1.1 *Scope*

Replace the second note by

This standard gives supplementary requirements for such enclosed distribution boards (DBU), which are stationary, type tested assemblies (TTA) for indoor use, containing protective devices and intended for use either in domestic (household) applications or in other places where unskilled persons have access for their use. Control and/or signalling devices may also be included They are for use on a.c., with a nominal voltage to earth not exceeding 300 V The outgoing circuits contain short-circuit protective devices, each *having a rated current not exceeding* 125 A *with a total incoming load current* not exceeding 250 A

NOTE - The nominal voltage to earth in an IT system is taken as the nominal voltage of the system

Unskilled persons normally have access to these assemblies, e.g. for switching operations and for replacing fuse-links

Requirements for assemblies for outdoor use are under consideration.

2 Definitions

2.1 *General definitions*

2.1.1.2 *Partially type tested assembly (PTTA)*

Not applicable

2.1.9 *Test situation*

Not applicable.

2.1.10 *Distribution board*

An assembly containing switching or protective devices (e.g. fuses or miniature circuit-breakers) associated with one or more outgoing circuits fed from one or more incoming circuits, together with terminals for the neutral and protective circuit conductors. It may also include signalling and other control devices. Means of isolation may be included in the board or may be provided separately

2.2 *Definitions concerning constructional units of assemblies*

2.2.8 *Withdrawable part*

Not applicable.

2.2.9 *Connected position*

The position of a removable part when it is fully connected for its normally intended function.

2.2.10 *Test position*

Not applicable.

2.2.11 *Disconnected position*

Not applicable.

2.3 *Definitions concerning the external design of assemblies*

2.3.1 *Open-type assembly*

Not applicable

2 3.2 *Dead front assembly*

Not applicable

2.3.3.3 *Desk-type assembly*

Not applicable.

2.3.4 *Busbar trunking system (busway)*

Not applicable.

2.4 *Definitions concerning the structural parts of assemblies*

2.4.15 *Parts for aesthetic purposes*

Parts which are provided only to improve the appearance of an assembly and are not intended to give any electrical or mechanical protection

2.5 *Definitions concerning the conditions of installation of assemblies*

2.5.4 *Movable assembly*

Not applicable.

2.7 *Gangways within assemblies*

Not applicable.

3 Classification of assemblies

Delete:

- the conditions of installation with respect to mobility (see 2.5.3 and 2.5.4).

4 Electrical characteristics of assemblies

4.2 *Rated current (of a circuit of an assembly)*

Renumber existing 4 2 to read 4 2.1.

Add a new sub-clause·

4.2 2 *Rated current of a distribution board*

The rated current of a distribution board is that stated by the manufacturer as the rated current of the incoming circuit or circuits If there is more than one incoming circuit the rated current of a distribution board is the arithmetic sum of the rated currents of all incoming circuits that are intended to be used simultaneously This current or currents shall be carried without the temperature rise of the several parts exceeding the limits specified in 7.3 when tested according to 8.2.1

4.8 *Rated diversity factor*

Replace the note and Table I by the following:

For the purpose of this standard the number of main circuits is the number of outgoing circuits connected to each supply phase. In the absence of information concerning the actual currents, the conventional values given in Table 1 may be used.

Table 1

Number of main circuits	Diversity factor
2 and 3	0 8
4 and 5	0 7
6 to 9 inclusive	0 6
10 (and above)	0.5

Delete the last sentence of 4.8.

5 Information to be given regarding the assembly

5.1 *Nameplates*

Add as second sentence:

The nameplates may be mounted behind a door or removable cover.

In the fourth line replace q) by r)

In c) replace 439-1 *by* 439-3

Replace the text of l) by

l) degree of protection (see 7 4.2 2 1), if greater than IP2XC according to IEC 529,

Add:

r) rated current of distribution board (see 4 2.2)

5.2 *Markings*

Add:

The diagrams and symbols used shall comply with the relevant IEC standards

6 Service conditions

6.2.9 *Delete the examples.*

Add.

For flush-type assemblies recessing into a wall is not considered to be a special condition

7 Design and construction

7 1 1 *General*

Add the following at the beginning of the first paragraph:

Assemblies intended for use by unskilled persons shall be designed as type-tested LV switchgear and controlgear assemblies (TTA).

Add at the end of the first paragraph.

For parts of distribution boards which are made of insulating materials the resistance to heat shall be verified according to 8 2.11. The resistance of insulating materials to abnormal heat and to fire due to internal electric effects shall be verified according to 8.2.12.

Add a second sentence to the second paragraph:

Ferrous structural parts of distribution boards, including enclosures, shall have adequate resistance to rusting when tested in accordance with 8.2.10.

Add a second sentence and note to the third paragraph:

Enclosures of distribution boards shall, in addition, withstand an impact strength test in accordance with 8.2.9

NOTE - Parts for aesthetic purposes and individual components need not be subjected to the impact tests

Add to the end of the clause·

Any cover which has to be removed during installation or maintenance shall not be used to support components to which conductors are connected if such conductors are subject to any stress when the cover is removed. In this case, a hinged door shall be used instead.

Doors and the like provided with hinges shall allow free access and ease of operation of built-in components.

7.1.2.2 *Isolating distances*

Not applicable.

7.1.3.5 *Replace by·*

Provision shall be made for the terminals for outgoing neutral conductors to correspond in number to the number of outgoing neutral conductors. These terminals shall be located or identified in the same sequence as their respective phase conductor terminals.

Terminals shall also be provided for the protective conductors of the incoming and outgoing circuits, which shall be similarly located or identified, and for any bonding conductors that may be required (e.g. as appropriate to the system).

7.2.1.1 *Delete reference to IP00.*

7.2.1.5 *Not applicable.*

7.4.2 *Add after the title:*

NOTE - Open type assemblies are not covered by this Part 3

Delete the second paragraph.

7.4.2.2.1 *Replace first sentence by:*

All external surfaces shall provide a degree of protection of at least IP2XC according to IEC 529.

Add:

For built-in equipment the degree of protection given in the relevant product standard shall apply.

The degree of protection is verified with all equipment in place and connected as in normal use according to the instructions of the manufacturer

7.4.2.3 *Protection by obstacles*

Not applicable.

7.4.3.2.2 *Protection by total insulation*

7.4.3.2.2 *d) Delete in the first paragraph the words:* "The enclosure shall give at least the degree of protection of IP4X*" *and the footnote.*

7.4.5 *Operating and maintenance gangways within assemblies*

Not applicable.

7 5.2.3 Not applicable

7.6.1 *Selection of components*

Add at the end of the first paragraph:

Fuses for outgoing circuits shall comply with the general requirements of IEC 269-3.

7.6.4 *Replace title by: Removable parts.*

Add at the beginning:

Withdrawable parts are not permitted in assemblies intended to be installed in places where unskilled persons have access for their use.

7.7 *Internal separation of assemblies by barriers or partitions*

Add:

The barriers may be omitted if circuits at lower voltages are wired in cables insulated according to the phase-to-earth voltage of the main circuits.

Safety extra-low voltage circuit conductors shall be in separate compartments, or separated from conductors of circuits at different voltages by a metal screen or sheath connected to the protective conductor, unless they are insulated for the highest voltage present, either individually, or collectively in multicore cables or other grouping of conductors.

7.8.3.6 Not applicable.

8 *Test specifications*

8.1 *Replace Table VII by the following:*

Table 7 - List of verifications and tests to be performed

Nos	Characteristics to be checked	Sub-clause	Test
1	Temperature-rise limits	8.1.1 a)	Verification of temperature-rise limits by test (type-test)
2	Dielectric properties	8.1.1 b)	Verification of dielectric properties by test (type test)
3	Short-circuit withstand strength	8.1.1 c)	Verification of the short-circuit withstand strength by test (type test)
4	Effectiveness of the protective circuit	8.1.1 d)	
	Effective connection between the exposed conductive parts of the assembly and the protective circuit		Verification of the effective connection between the exposed conductive parts of the assembly and the protective circuit by inspection or by resistance measurement (type test)
	Short-circuit withstand strength of the protective circuit		Verification of the short-circuit withstand strength of the protective circuit by test (type test)
5	Clearances and creepage distances	8.1.1 e)	Verification of clearances and creepage distances (type test)
6	Mechanical operation	8.1.1 f)	Verification of mechanical operation (type test)
7	Degree of protection	8.1.1 g)	Verification of degree of protection (type test)
8	Construction and marking	8.1.1 h)	Verification of construction and marking (type test)
9	Impact strength	8.1.1 i)	Verification of impact strength (type test)
10	Resistance to rusting	8.1.1 j)	Verification of resistance to rusting (type test)
11	Resistance of insulating materials to heat	8.1.1 k)	Verification of resistance of insulating materials to heat (type test)
12	Resistance of insulating materials to abnormal heat and to fire	8.1.1 l)	Verification of resistance of insulating materials to abnormal heat and to fire due to internal electric effects (type test)
13	Wiring, electrical operation	8.1.2 a)	Inspection of the assembly including inspection of wiring and if necessary, electrical operation test (routine test)
14	Insulation	8.1.2 b)	Dielectric test (routine test)
15	Protective measures	8.1.2 c)	Checking of protective measures and of the electrical continuity of the protective circuits (routine test)

8.1.1 *Type tests* (see 8.2)

Add:

- *h)* verification of construction and marking (8.2.8);
- *i)* verification of impact strength (8.2.9);
- *j)* verification of resistance to rusting (8 2.10),
- *k)* verification of resistance of insulating materials to heat (8.2.11);
- *l)* verification of resistance to abnormal heat and fire (8.2.12).

Replace the last two paragraphs by:

The type tests are arranged in three separate sequences as detailed in table 7a. A sample selected for testing to a given sequence shall complete all the tests in that sequence in the order stated

Table 7a - Sequence of type tests

Sequence reference	Type tests
A	*h), a), b), i), g)*
B	*f), e), l), k)*
C	*c), b), d), j)*

Four separate samples shall be provided for each test sequence. There shall be no failures by any samples during any of the tests *a), c), d), e), g)* or *h)* If the first sample submitted to a test sequence completes the sequence satisfactorily no further testing to that sequence is required If, however, a sample submitted to a test according to *b), f), i), j), k)* or *l)* fails, the relevant test sequence has to be repeated on the remaining three samples and there shall be no failure

8.1.2 ***Routine tests (see 8.3)***

Replace b) by:

b) dielectric test (see 8.3.2);

A dielectric test is not required on distribution boards containing busbars and/or prefabricated main circuit wiring only, nor on simple constructions where an inspection under *a)* is sufficient.

8.2.1.3 *Temperature-rise test*

Replace second paragraph by:

For this test the distribution board is loaded with its rated current (see 4.2). This current shall be distributed amongst the smallest possible number of outgoing circuits so that each of these circuits is loaded with its rated current multiplied by the rated diversity factor, as stated in 4.8 If the exact total load cannot be obtained by a number of devices loaded to this current, one circuit only may be loaded to a lower value to give the correct total. Fuses or miniature circuit-breakers shall be fitted as specified by the manufacturer and the power losses of fuse-links shall be stated in the report. (Tests may be carried out using dummy fuse-links having the maximum power loss as specified in the relevant specification).

NOTE - The appropriate diversity factor should be stated by the manufacturer in the type-test report

8.2 1 3.2 Not applicable

8.2.1.3.3 Not applicable

8.2.1.3 4 Not applicable

8 2.2 2 *Add.*

This test is made without the components intended to be mounted in the openings of the enclosure of the assembly

8 2 8 *Verification of construction and marking*

Compliance with Clause 5, 7 1 3, 7.4, 7 6, 7 7 and 7.8 shall be checked by inspection.

8.2 9 *Verification of impact strength*

Under consideration

8.2 10 *Verification of resistance to rusting*

The following test applies to assemblies without built-in components, to separate parts or to pieces of large parts, provided the protection against rust is the same as in the final construction.

It may alternatively be applied to a test sample prepared with the same protection against rust

All grease is removed from the parts or representative samples of the steel enclosures of the distribution board to be tested, by immersion in a cold chemical degreaser such as methylchloroform or refined petrol for 10 min. The parts are then immersed for 10 min in a 10 % solution of ammonium chloride in water at a temperature of (20 ± 5) °C.

Without drying but after shaking off any drops, the parts are placed for 10 min in a box containing air saturated with moisture at a temperature of (20 ± 5) °C

After the parts have dried for 10 min in a heating cabinet at a temperature of (100 ± 5) °C and have been left at room temperature for 24 h, their surfaces shall show no signs of rust

Traces of rust on sharp edges and any yellowish film removable by rubbing are ignored.

For small helical springs and the like, and for inaccessible parts exposed to abrasion, a layer of grease may provide sufficient protection against rusting Such parts are subjected to the test only if there is doubt about the effectiveness of the grease film, and the test is then made without previous removal of the grease

8.2.11 *Verification of resistance of insulating materials to heat*

Compliance is checked by the tests of 8.2.11.1, 8.2.11.2 and 8.2.11.3 These tests are applied to distribution boards having their built-in components (switching devices indicator lights, etc) removed

8.2.11.1 The distribution board shall be kept for 168 h in a heating cabinet at a temperature of $(70\ ^{+2}_{\ 0})$ °C

The structural parts of the assembly (including enclosures, covers, etc) shall not undergo any change impairing further use of the distribution board

Marking shall still be easily legible

It is permissible to test individual parts (panels, boxes, enclosures, etc) of the distribution board, provided proper precautions are taken to make the test representative

Where installed components are likely to affect the result of the test, these components shall be incorporated for the test

8.2.11.2 Parts of insulating material necessary to retain current-carrying parts in position are subjected to a ball pressure test by means of the apparatus shown in Figure 1 of this part

NOTE - For the purpose of this test a protective conductor, PE, is not considered as a current carrying part

The surface of the part to be tested is placed in the horizontal position and a steel ball of 5 mm diameter is pressed against this surface by a force of 20 N.

The test is made in a heating cabinet at a temperature of (125 ± 2) °C After 1 h, the ball is removed. The sample is then cooled down, within 10 s, to approximately room temperature by immersion in cold water The diameter of the impression caused by the ball is measured and shall not exceed 2 mm

8.2.11.3 Other parts of insulating material not necessary to retain current-carrying parts in position, even if they are in contact with them, are subjected to a ball pressure test as per 8.2.11.2, but the test is made at a temperature of (70 ± 2) °C or at a temperature of (30 ± 2) K in excess of the temperature rise of the relevant part determined during temperature-rise tests (in accordance with 8 2.1.3), whichever is the higher

8.2.12 *Verification of resistance of insulating materials to abnormal heat and to fire due to internal electric effects*

Tests shall be carried out in accordance with the principles of IEC 695-2-1.

8 2.12.1 *General description of the test*

See Clause 3 of IEC 695-2-1.

8.2 12 2 *Description of test apparatus*

The apparatus to be used shall be as described in Clause 4 of IEC 695-2-1

A piece of white pinewood board, approximately 10 mm thick and covered with a single layer of tissue paper, is positioned at a distance of 200 mm below the bottom surface of the distribution board

Tissue paper is specified in 6.86 of ISO 4046 (1978) (Paper vocabulary - second series of terms), as thin, soft, relatively tough paper generally intended for packing delicate articles, its substance being between 12 g/m^2 and 30 g/m^2

8.2 12.3 *Preconditioning*

The specimen is stored for 24 h in an atmosphere having a temperature between 15 °C and 35 °C and a relative humidity between 35 % and 75 % before starting the test.

8.2 12 4 *Test procedure*

The apparatus is placed in a substantially draught-free dark room, so that the flames occurring during the test are visible.

Before starting the test, the thermocouple is calibrated in accordance with Clause 6 of IEC 695-2-1.

For the test, the procedure given in 9 1, 9 2 and 9.3 of IEC 695-2-1 shall be followed.

After each test, it is necessary to clean the tip of the glow wire of any residue of insulating material, for example by means of a brush.

8.2.12.5 *Severities*

The temperature of the tip of the glow wire shall be in accordance with Table 12. The duration of application shall be (30 ± 1) s.

Table 12

Parts necessary to retain current-carrying parts in position	(960 ± 10) °C
Parts intended to be installed in hollow walls	(850 ± 10) °C
All other parts including parts not necessary to retain current-carrying parts in position and parts intended to be embedded in walls which are combustible with difficulty	(650 ± 10) °C

8.2.12.6 *Observations and measurements*

During application of the glow-wire and during a further period of 30 s, the specimen, the parts surrounding the specimen and the layer of tissue paper placed below it shall be observed.

The time at which the specimen ignites and the time when flames extinguish during or after the period of application are noted.

The specimen is considered to have withstood the glow-wire test.

- if there is no visible flame and no sustained glowing, or
- if flames or glowing of the specimen extinguish within 30 s after removal of the glow-wire.

There shall be no burning of the tissue paper or scorching of the pinewood board.

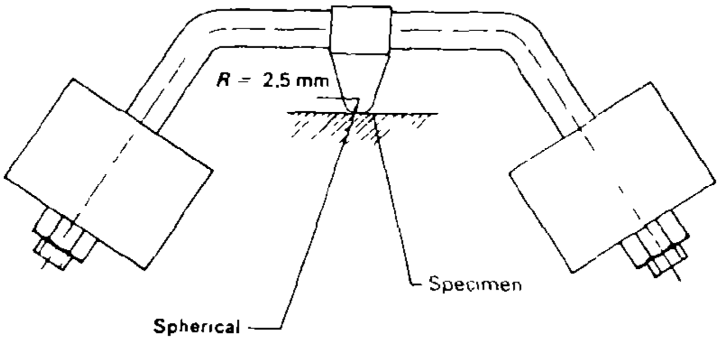

Figure 1 – Ball pressure test apparatus

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